

## RHEUM EMODI AS VALUABLE MEDICINAL PLANT

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### ABSTRACT

India is one of the twelve mega-biodiversity countries of the world having rich vegetation with a wide variety of medicinal plants and a tradition of plant-based knowledge distributed amongst a vast number of ethnic groups. Rheum emodi or Himalayan rhubarb is a perennial herb belongs to family Polygonaceae. It has been used in various traditional systems as laxative, tonic, diuretic and to treat fever, cough, indigestion, menstrual disorder since antiquity. This paper consists of literature of Rheum emodi regarding its ethno botany, folkloric uses, chemical properties and pharmacological studies. The most common constituents of Rheum emodi are anthraquinone (rhein, chrysophanol, aloe-emodin, emodin, physcion, and their glycosides) and stilbene (picetannol, resveratrol and their glycosides). Studies have shown that Rheum emodi possess anticancer, antioxidant, anti-inflammatory, antimicrobial, antifungal, antidyslipidemic, ant platelet, ant diabetic, antiulcer, hepatoprotective, immunoenhancing and nephroprotective activities. These studies raised the therapeutic efficacy of rhubarb in diverse ailments. It is essential that this medicinal plant should study more extensively to confirm these therapeutic effects and to check the traditional claim that this plant have significant medicinal properties as is reported in the traditional knowledge of the indigenous people that the plant is used in the treatment of gastrointestinal infections, respiratory infections, liver and skin infections.

**KEYWORDS:** Rheum Emodi, Phytochemistry, Antiulcer, Antidyslipidemic, Hepatoprotective, Antioxidant

### 1. INTRODUCTION

Rheum emodi (Rhubarb) is a perineal stout herb belonging to family polygonaceae and has been cultivated over 5000 years for its medicinal properties. It is distributed in the temperate and subtropical regions of the world, especially in Asia and can be cultivated at an altitude above 1800m. The herb is reported to possess antioxidant, antimicrobial, antifungal, anticancer, wound healing and immune enhancing activity and is commonly used worldwide herb and often known as "the wondrous drug" because of its extensive medicinal uses [1-2]. Rhubarb contains a variety of compounds like flavonoids, anthraquinone glycosides, tannins, volatile oils and saponins [4-5] and has long been used as an ingredient of purgative, laxative and stomachic [3]. Paradoxically, although larger doses were used as a laxative, small dose were used to treat dysentery and diarrhea [6]. Rhubarb has also been used in jams, jelly and sauce by its tart flavor [7]. There are three

main types of rhubarbs, viz. the Chinese Rhubarb, the Indian Rhubarb, and the Rhapontic Rhubarb [3]. Chinese Rhubarb comprises of dried rhizomes of *Rheum palmatum* L., and *Rheum officinale* Baill [6]. *Rheum emodi*, commonly known as Indian or Himalayan Rhubarb, is official in Indian Pharmacopeia [8].

## 2. HISTORIC OVERVIEW

The use of this drug has been traced in medicine from very early time. The Chinese appear to have been acquainted with the properties of Rhubarb from a period long anterior to Christian era around 2700BC [9]. It was first documented in “The ShenNong Ben Cao Jing”, the earliest book on materia medica in the world [10]. It was being imported in Greece and Rome for medicinal purposes in the 1st century. Dioscorides and Galen described the good medicinal properties of rhubarb in their manuscripts and Avicenna has quoted the use of rhubarb in almost all system of body [7, 11-13]. By the 10th century this root became a major export of Asia [14] and gradually spreads to India, Russia, Europe and North America. In Europe it was much price drug even more than opium and in France (in 1542) it was sold for ten times the price of cinnamon and four times that of saffron [7, 14].

## 3. ETYMOLOGY OF RHUBARB

The word rhubarb has been derived from Latin word “rha” (river) and “barb” (barbarian land). In ancient times, rhubarb roots were imported by Romans from barbarian lands which were beyond the Volga or Rha River. Imported from barbarians across the Rha, the plant became *Rhabarbarum* [7, 11]. According to Lindley's Treasury of Botany, some authorities derive the name from the Greek rheo ('to flow'), in allusion to the purgative properties of the root [15].

## 4. PLANT DESCRIPTION

### 4.1 Different Names in Different Languages

*Rheum emodi* or Himalayan rhubarb is known by various vernacular names in different geographical regions or system. Detail is mentioned in below Table.

**Table 1**

Language/System	Name
English	Indian Rhubarb or Himalayan Rhubarb [16]
Sanskrit	Gandhini, Revatchini Hindi Dolu [3], Pita [18]
Kashmiri	Pumbehakh [17]
Tamil	Nattu-ireval-chini, Nattu-manjal-chinni-kizhangu [18]
Telugu	Nattu-revalchini [16]
Arabic	Rewand [18]
Persian	Rewandchini [18]
Ayurvedic	Amlaparni, pitamuuli, Gandhini Revatikka [19]
Siddha	Revalchinikattai, Nattirevaichini [19]
Unani	Revandchini [17].
Synonym	<i>Rheum australe</i> D. Don [19]

### 4.2 Occurrence and Distribution

*Rheum emodi* is a stout herb, endemic to the Himalayan region distributed in the temperate and subtropical region from Kashmir to Sikkim at an elevation of 2800-3000m in India. It grows in the alpine zone on rocky soils, moraines and cervices [20].

### 4.3 Botanical Description

*Rheum emodi* Wall.exMeissn is a leafy perennial herb [21], 1.5-3.0 m in height [3]. Roots very stout. Radical leaves longpetioled, very large, often 60 cm in diameter, orbicular or broadly ovate obtuse, base cordate 5-7 nerved, papillose beneath, subscaberulous above; petiole 30-45 cm, very stout, scaberulous. Panicle is 0.6-0.9 m, papilloselypuberulous, fastigiately branched and leafy with erect strict branches; flowers small 3 mm diameter, dark purple or pale red, in axillary panicles. Fruit ovoid-oblong, 13 mm long, purple, base cordate, apex notched, wings narrower than the disk [22]. Roots and rhizomes are the main parts used as drug and are collected in October to November. Root of Indian Rhubarb is darker, inferior in aroma, coarser and untrimmed, is not decorticated. Fresh rhizome is 6 to 12 inches long, and the freshly fractured surface is dull orange to yellowish brown [4].

## 5. PHARMACOLOGICAL ACTIONS AND TRADITIONAL USES

Many plant species belonging to different families have so far been reported to have a traditional medicinal use by different communities of India. However these days we have new and different medicines for these diseases, which unfortunately are accompanied by various side effects. Subsequently, there is a need to have the active principals of natural origin which can be used for the treatment and/or prevention of diseases/infections with no side effects. Thus, there has been a growing interest in natural plant products as these are more compatible to the human body with little or no toxic side effects. *Rheum emodi* is considered as purgative, stomachic, and astringent tonic [3, 16, and 21]. It also possesses aperient, emmenagogue and diuretic properties [3, 21]. Root is regarded as expectorant and appetizer. Anti-inflammatory, anti-dysentery and alexentric actions have also been ascribed [21]. Rhubarb is widely used in various traditional systems such as, UNANI, Ayurveda, Chinese etc. The uses of Rhubarb by Unani scholars are described in Table 1. Indian rhubarb is used as a purgative and astringent tonic. Its primary action is of mild purgation; but it has also astringent property, so that it's secondary effect is to confine the bowels, hence it is well fitted for use in simple diarrhoea, but not in constipation or any affection in which a continuous aperient action is necessary. It is useful remedy in ailments of children. For the errors in diet of children and for the diarrhoea set up by undigested food, it is best given combined with sodium bicarbonate or magnesia. Rhubarb forms an important ingredient of a large variety of compound. Combined with ginger it may be given in the form of pills in cases where the bowels are sluggish [16]. Root is regarded as panacea in local home remedies and is used in stomach problems, cuts, wound, and muscular swelling, tonsillitis and mumps [17]. Some persons chew the root, and to them this is a very good way of taking it [16]. Powdered roots are used for cleaning teeth and sprinkled over ulcers for quick healing [3]. Ethno-medically leaf-stalk, leaves and flowers are consumed as vegetables after cooking [23]. In Assam its leaves consumed as vegetables and cultivated for this purpose. Leaves are also dried and stored for consumption along with other foods, or made into a preserve. It is however stated that cook stalks act as a powerful purgative [3]. Besides the medicinal uses, it is also used for coloration of textile and wooden material [24].

## 6. PHYSICOCHEMICAL STUDY

Physicochemical study of *Rheum emodi* is carried out by Aslam et al. [4] The total-ash value of the plant is recorded as 4% whereas, acid insoluble and water insoluble is found to be 0.6% and 2.6% respectively.

Table 2: Uses of Rhubarb

	Ailments	Approach
<b>Gastrointestinal system</b>	Jaundice	Rhubarb taken with decoction of root of <i>Foeniculumvulgare</i> , <i>Cichoriumintybus</i> , <i>Capparisspinosa</i> and <i>Apiumgraveolens</i> [12].
	Diarrhea	Taken with dried roses or pomegranate or gum of acacia [13].
	Indigestion	Alone or taken with Aloe vera and <i>Chebolicmyrobalan</i> . Taken with aniseeds or lukewarm water [12].
<b>Urogenital system</b>	Retention of urine	Rhubarb is taken along with seeds of <i>Cucumismelo</i> and <i>Tribulusterrestris</i> [11].
	Dysmenorrhoea with Oligomenorrhoea	Powdered rhubarb admixed is taken 2 days before menstruation and continue three days during menstruation [11].
	Menorrhagia	Taken with juice of <i>Plantago major</i> and <i>Nardostachysjatamansi</i> [12].
<b>Respiratory system</b>	Cough and asthma	Rhubarb is crushed and make pill with resins of quince [11].
	Haemoptysis	Crush root is chewed and kept in mouth for some time [12].
<b>Nervous system</b>	Headache, Migraine, Paralysis	Rhubarb is taken with <i>Chebolicmyrobalan</i> and <i>Polyporusofficinalis</i> and Aloe vera [11, 12].
<b>Musculoskeletal system</b>	Bruises	Rhubarb together with tila (a preparation by grapes water) taken orally [13].
	Muscular pain / body ache and Arthritis	Externally rhubarb is recommended for hot swellings in combination with some liquid [12, 13].
	Swelling and Inflammation	Oil of rhubarb is applied on affected part [13]. Its powder is also recommended for the management of abscess [11].
	Abscess	Taken with decoction of asarum [12].
<b>Skin</b>	Freckle and other skin marks.	Root is crushed and grinded and makes paste with vinegar and applied externally on affected part [11, 12, 13].
	Melasma	Powder of root is applied with fresh milk [11].

## 7. PHYTOCHEMISTRY

Rheum emodi possess a number of phytoconstituents and these are: anthraquinones, anthrones, stilbenes, oxanthrone ethers and esters, flavonoids, lignans, phenols, carbohydrate and oxalic acid [23]. The most common constituents of Rheum emodi are anthraquinone and stilbene. Anthraquinones include rhein, chrysophanol, aloe-emodin, emodin, physcion (emodin monomethyl ether), chrysophanein and emodin glycoside. Stilbene includes picetanol, resveratrol and their glycosides [25]. Different derivatives of oxanthrone include oxanthrone ether (revandchinone-4), oxanthrone esters (revandchinone-1 and revandchinone-2), and revandchinone-3 [26-27]. Other complex compounds have also been reported, including torachryson 8-O-b-D-glucoside, sulfated anthraquinone glycoside sulfemodin 8-O-b-D-glucoside b-asarone and rhein 11-O-b-D-glucoside [28]. Tannins are also present in rhubarb which includes hydrolysable tannins, containing ester or glycosidic bonds composed of gallic acid, glucose and other monosaccharides and condensed tannins, derived primarily from the flavone derivatives catechin and leucocyanidin [4].

## 8. PHARMACOLOGICAL STUDIES

Recent studies have showed that Rheum emodi possess anticancer, antioxidant, antidiabetic, antifungal, antiulcer along with hepatoprotective and nephroprotective properties and theses action are due to a number of compounds isolated from it.

### 8.1 Anticancer Activity

Rajkumar et al. tested the methanolic and aqueous extracts of the Rheum emodi rhizome in human breast carcinoma (MDAMB- 435S) and liver carcinoma (Hep3B) cell lines for cytotoxicity. They found that the extracts exhibited extensive concentration-dependent cytotoxicity in tested cells [21, 29].

### 8.2 Antidiabetic Effect

Radhika et al. carried out a study to evaluate the antidiabetic effect of Rheum emodi rhizome extract and to study the activities of hexokinase, aldolase and phosphoglucosomerase, and gluconeogenic enzymes such as glucose-6-phosphatase and fructose -1, 6-diphosphatase in liver and kidney of normal and alloxan induced diabetic rats. Oral administration of 75 % ethanolic extract (250 mg/kg body weight) for 30 days, resulted in decrease in the activities of glucose-6-phosphatase, fructose-1, 6-disphosphatase, aldolase and an increase in the activity of phosphoglucosomerase and hexokinase in tissues [20]. Radhika et al. also investigated therapeutic effects of Rheum emodi rhizome extract in another study on certain biochemical marker like aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and LDH in the serum, liver and kidney tissue in alloxan – induced diabetes mellitus in rats. They have found that 250 mg/kg oral administration of Rheum emodi rhizome extract of 75% ethanolic extract to diabetic rat for 30 days restored all marker enzymes to near control level [30].

### 8.3 Antidyslipidemic Activity

Ethanolic extract of Rheum emodi shown antidyslipidemic effect in a study conducted by Mishra et al. Chrysophanol, emodin, chrysophanol 8-O- $\beta$ -D-glucopyranoside and emodin 8-O- $\beta$ -D glucopyranoside were active constituents and has significant effect in triton induced rats by reducing plasma lipids level. Emodin showed significant lipid lowering activity in high fed diet model [31].

### 8.4 Antifungal Activity

Rhein, physcion, aloe-emodin and chrysophanol isolated from Rheum emodi rhizomes exhibited antifungal activity against *Candida albicans*, *Cryptococcus neoformans*, *Trichophytonmentagrophytes* and *Aspergillusfumigatus* (MIC 25- 250 $\mu$ g/ml) responsible for skin diseases in India [32]. In a different experiment, three compounds isolated from the Rheum emodi rhizome (revandchinone-1, 3 and 4) exhibited antifungal activity against *Aspergillusniger* and *Rhizopus oryzae*, with inhibition zone diameters of 8-9 and 9-11 mm for the 100 and 150 g/ml test concentrations, respectively [26].

### 8.5 Anti-Inflammatory Activity

Chauhan et al. studied the anti-inflammatory activity of the methanol extract of the rhizome (500 mg/kg). The anti-inflammatory activity was evaluated by using carrageenaninduced paw oedema. It was found that the degree of inhibition of oedema increased with time, reaching maximum inhibition after 5 h. This inhibitory activity was comparable to the control drug Ibuprofen (50 mg/kg body weight) [25].

## 8.6 Antimicrobial Activity

Antimicrobial activity compound of Rheum emodi was investigated by Babu et al. Compounds were tested against gram positive (*Bacillus subtilis*, *Bacillus sphaericus* and *Staphylococcus aureus*) and gram negative (*Klebsiella aerogenes*, *Chromobacterium violaceum* and *Pseudomonas aeruginosa*) bacteria. Revandchinone-1 and 3 had lower degrees of antibacterial activity (inhibition zone diameters of 7–9 mm for the 30 and 100 g/ml test concentrations) than did revandchinone-4 (inhibition zone diameter of 12–14 mm at both the 30 and 100 g/ml test concentrations) [26].

## 8.7 Antioxidant Activity

The 2,2-diphenyl-1-picrylhydrazyl (DPPH) and hydroxyl radical scavenging activities, inhibitory effects on lipid per oxidation (LPI) and Fe<sup>3+</sup> reducing antioxidant properties of methanolic/aqueous extracts of the Rheum emodi rhizome were studied. Furthermore, the extracts proved to contain a high number of phenolic compounds, which were found to have strongly significant positive correlation with free radicals (DPPH and OH) scavenging efficacies, percentages of LPI and Fe<sup>3+</sup> reductions [21].

## 8.8 Antiplatelet and Anticoagulant Activities

Seo EJ et al. investigated the effects of anthraquinone derivatives isolated from rhubarb on platelet activity. Of four anthraquinone derivatives isolated from rhubarb examined, chrysophanol-8-O-glucoside (CP-8-O-glc) was found to have the most potent inhibitory effect on collagen- and thrombin induced platelet aggregation. CP-8-O-glc-treated mice showed significantly prolonged bleeding times. Furthermore, CP-8-O-glc was found to have a significant inhibitory effect on rat platelet aggregation ex vivo and on thromboxane A<sub>2</sub> formation in vitro [33].

## 8.9 Antiulcer Activity

Antiulcer effect of ethanolic extract of rhizome of Rheum emodi was investigated on pyloric ligation-induced ulcers in rats by Amandeep et al. It was found that there is reduction in ulcer index along with the reduction in volume and total acidity, and an increase in the pH of gastric fluid [34].

## 8.10 Hepatoprotective Activity

The hepatoprotective activity of the ethanolic extracts of Rheum emodi rhizome against CCl<sub>4</sub>-induced liver damage in Wistar rats has been evaluated by Ibrahim et al. Carbon tetrachloride administration caused a significant increase in the serum activities of AST, ALT and ALP and a similar increase in the total bilirubin. Oral administration of Rheum emodi at 3.0 g/kg significantly decreased the above elevated parameters, and the normal structure of the liver pattern was restored [8]. Other similar study by Akhtar et al. has confirmed the hepatoprotective effect of aqueous extract of Rheum emodi against liver damage induced by paracetamol in albino rats [35].

## 8.11 Immune-Enhancing Effect

Konsar F et al. studied the immune-enhancing activity from ethyl acetate rhizome extract of Rheum emodi on the cell lines and it found to have an immune-enhancing effect through the release of various cytokines. There is a dose-dependent increase in the release of NO (Nitric Oxide) and cytokines TNF- $\alpha$ , IL-12, and a decrease in IL-10 by RAW 264.7 in macrophages cell line in the presence of extract alone [36].

### 8.12 Nephroprotective Effect

The renal effects of water-soluble (W-S) and water-insoluble (W-INS) portions of the alcoholic extract of Rheum emodi were investigated on cadmium chloride, mercuric chloride, potassium dichromate and gentamicin-induced nephrotoxicity in rats and normal rats by monitoring the levels of urea nitrogen and creatinine in serum. W-S fraction has nephroprotective effect on all the proximal tubule segments (S1, S2 and S3) possibly through antioxidant action of the tannins present in the fraction [37].

### CONTRAINDICATIONS

Its use is prohibited for the patients suffering from gout, rheumatism, epilepsy and uric acid troubles, for people with a history of renal or gall bladder stones [3, 16]. The rhizome contains some oxalic acid, which, when consumed, can combine with calcium in the blood to form insoluble calcium oxalate crystals that may be deposited in the kidneys or gall bladder. It is not fitted for inflammatory or febrile cases although it seldom act as irritant. When given internally, the roots impart a deep tinge to urine [16].

### CONCLUSIONS

The above literature shown that Rheum emodi is an herb of enormous therapeutic effects and has been used in numerous ailments specially for constipation, indigestion, diarrhea, muscular pain, skin problems and menstrual disorder and. A number of compounds are isolated from it; anthraquinones and stilbenes are the most common which are responsible for its extensive use. Further studies are required to isolate other biological active constituents responsible for its therapeutic use and also to validate the traditional knowledge of rhubarb.

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